

# **CIMPA Research School**

## **Scientific Report**

**Title of the school :** Contrôle, Problèmes Inverses et Géométrie

**Dates :** From 18 to 28 april 2018

**Localization :** Hammamet, Tunisia.

### **I. Generalities**

The control and stabilization of partial differential equations (PDE's) and inverse problems are two important and related subjects in the analysis of PDE's. Their study uses several tools, in particular energy inequalities. Furthermore, Riemannian geometry is on the border of these two thematics.

This research school, presented courses for training in these various fields: control and stabilization, inverse problems, Carleman inequalities, micro-local analysis and geometry.

In addition several lectures were given in connections with these subjects.

### **II. Scientific content**

**Courses** ( 6 hours each and 10 hours for courses 6 et 7 )

Program in attached document.

**Course 1:** Karine Beauchard ( ENS Rennes )

Small time local controllability of nonlinear control systems .

**Course 2:** Alberto Ruiz (Univ. Autonoma Madrid )

Inverse scattering problems for perturbations of laplacean and Calderón inverse problems.

**Course 3:** Abdelghani Zeghib ( ENS Lyon )

Configuration spaces: Geometry, Topology, Dynamics, Physics and Technology

**Course 4:** Emmanuel Trélat ( Univ. Pierre et Marie Curie )

Stabilization of PDE's.

**Course 5 :** Camille Laurent ( Univ. Pierre et Marie Curie)  
Analyse micro locale et application à la théorie du contrôle.

**Courses 6 & 7 :** Jérôme Le Rousseau ( Univ. Paris 13 ) & D.D.S Ferreira ( Univ. Lorraine )  
Inégalités de Carleman et applications.

### **Lectures ( One hour each )**

**Lecture 1 :** Gilles Lebeau (Univ. de Nice)  
Spectral inequalities for the Schrödinger operator.

**Lecture 2:** Mourad Bellassoued (Univ. Tunis El Manar)  
Théorème de Borg-Levinson pour un opérateur de Schrödinger magnétique.

**Lecture 3 :** Assia Benabdallah (Univ. Aix-Marseille)  
Hyperbolic phenomena in control of Parabolic Equations

**Lecture 4:** Maher Moakher (Univ. Tunis El Manar)  
Riemannian and information geometries of the cone of positive-definite matrices and their applications.

**Lecture 5 :** Ibtissem Ben Aicha (Univ. Tunis El Manar )  
Optimal stability for a first order coefficient in a non- self-adjoint wave equation from Dirichlet-to-Neumann map.

**Lecture 6:** Matthieu Léautaud (Univ. Paris-Diderot)  
Estimées d'effet tunnel et contrôlabilité approchée pour les équations hypoelliptiques.

**Lecture 7 :** Sylvain Ervedoza (Univ. Paul Sabatier , Toulouse)  
Sur le coût du contrôle de la chaleur en temps petit en dimension un d'espace.